tion of a difference. From the point of view of ethnological technique the two principles can not be treated in an identical way, for whereas diffusion can be demonstrated, independent development does not, in the nature of the case, permit of rigorous proof. The assertion of independent development always involves the negation of diffusion, a negation based on negative evidence, absence of proof of diffusion. Thus, it could always be claimed that at some time somehow diffusion has occurred. Such a claim would be unanswerable. At the same time it is obvious that the above constitutes a methodologically impossible procedure. A relatively small number of cultural similarities—speaking in particular of primitive cultures—can be referred to diffusion by internal evidence. Such is the case when the similarities brought into juxtaposition are so complex and minute that the probability of their independent recurrence approaches or equals zero. But let us repeat, the number of such instances is small, far smaller than generally alleged, far smaller than one might wish. Outside of these cases there lies the tremendous array of cultural similarities which may have arisen through diffusion or by independent development. In all such cases independent development must be assumed until diffusion is proved or, at least, made overwhelmingly probable.

We need not here enter into a discussion of the highly complicated technique demanded of such demonstrations. Professor Smith voices the conviction that the high pre-Columbian civilization in America "was derived from the late New Empire Egyptian civilization, modified by Ethiopian, Mediterranean, West Asiatic, Indian, Indonesian, East Asiatic and Polynesian influences." Professor Smith does not furnish the proof of his contention; it would therefore be premature to pass judgment upon it. But the author forestalls the character of his proof. We read:

> The proof of the reality of this great migration of culture is provided not merely by the identical geographical distribution of a very extensive series of curiously distinctive, and often utterly bizarre, customs and beliefs, the precise dates and circumstances of the origin of which are known in their parent countries; but the fact that these strange ingredients are compounded in a definite and highly complex manner to form an artificial cultural structure, which no theory of independent evolution can possibly explain, because chance played so large a part in building it up in its original home.

It seems from this highly significant and interesting passage that Professor Elliot Smith will base his proof largely on quantitative and qualitative evidence derived from the constitution of the cultural complex itself. The publication of Professor Smith's work, notice of which is given in a footnote, will be awaited with the greatest interest and impatience by his American colleagues; and if his proof withstands the test of their open-minded examination, the critical ethnologist will be the last one to want to lift a stone for the destruction of what would then constitute an invaluable addition to our knowledge of the ancient civilizations of the world.

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SOME OBJECTIONS TO MR. ELLIOT SMITH'S THEORY

TO THE EDITOR OF SCIENCE: In your issue for August 11, 1916, there appeared a very interesting theory as to the origins of the pre-Columbian American civilizations. It is the belief of the writer of that article, Mr. G. Elliot Smith, that the distinguishing characteristics of American cultures (such as pyramidal structures, the use of irrigation canals, the custom of mummifying the dead, etc.) are derived, by means of a "great cultural wave," from the ancient civilization of Egypt. The "cultural wave" is said to have passed from the valley of the Nile into Assyria, thence to India, Korea, Siberia, the Pacific islands and America. The wave is said to have started about B.C. 900.

This theory is important. But there are several serious objections to it:

1. If Mr. Elliot Smith is right in thinking that the American aborigines in Mexico, Peru, etc., used pyramidal structures, numer-

ous irrigation systems, and many customs closely resembling those of the ancient Egyptians because their culture was really an offshoot of the Egyptian culture, how can it be explained that in all pre-Columbian America there was no such thing as a wheeled vehicle? Chariots of various sorts were much used in ancient Egypt, as well as in the intervening areas, yet there is not a shred of evidence to prove that the Indians of America ever knew anything even remotely resembling them. Had the founders of American culture come from an area where wheeled vehicles were known, is it not inevitable that they would have made use of such vehicles during their long journey? Does it not seem that wheeled vehicles would be more useful to them than pyramids, and that therefore they would have been remembered first on the arrival of the wanderers in their new land? It is difficult to believe that the American aborigines were the cultural descendants of a wheel-using people, for wheels, being essentially useful, would inevitably have persisted as a feature of their material culture, had that been the case.

2. In a like manner, one is puzzled by a lack of any ships or vessels of advanced type among the American Indians. Even in Mexico, Yucatan and Peru, where civilization was, in other respects, of a well-advanced type, there were no really complicated vessels before the coming of the Spaniards. On the coast of Ecuador there was found the most elaborate type of boat known to the Indian race. It consisted of a raft of light wood with a flimsy platform on which stood a rude shelter. A simple sail, sometimes even two, was used. Large canoes with sails were also used in Yucatan. Not one of these, however, is worthy to be compared with even the earliest and simplest ships used in Egypt.[1] It is known, of course, that boat-building reached very early a high development in Babylonia, India and China, through all of which the "cultural wave" is said to have passed.

3. Finally, the date B.C. 900 is altogether too late for the beginning of the alleged migration of cultures. If this migration took place at all, it must have left Egypt much earlier than this, for we have the Tuxtla statuette (dated about B.C. 100) to prove that even before the commencement of our era the Maya calendar had already gone through its long preliminary stages and was already in existence in practically its final form. No doubt every one will admit that the period B.C. 900–100 is entirely too short for a "great cultural wave" to roll from Egypt to America in. The year B.C. 1500 is much more likely to be the date needed.

In conclusion, the present writer admits that, despite the three objections here noted (and several others), there is a large amount of seemingly corroborative evidence that tends to support the views of Mr. Elliot Smith. It will, however, be a long time before American anthropologists will be forced to accept these views as final, and many tests, based on physical anthropology, history, archeology, etc., will have to be successfully applied before the Egyptian source of American civilization is finally proved.

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[1] *Cf.* Joyce, *S. Am. Arch.*, 1912, pp. 60, 125, and Plate XIII.; Joyce, "Mex. Arch.," 1914, pp. 203 and 300; Beuchat, 1912, p. 651; Pinkerton's "Voyages," 1808–14, Vol. XIV., pp. 407–409; Torr, "Ancient Ships," 1895, pp. 2, 4, 9, etc., and Plate I.; Mookerji, "Indian Shipping," 1912.

RESEARCH FUNDS FOR PHARMACY

To the Editor of Science: On page 230 of Science the appropriation of $5,000 made by the regents for specific research in engineering is mentioned as the only research appropriation at Wisconsin outside of the agricultural grants. For the sake of completeness you may care to know that several years ago the state legislature made an appropriation of $2,500 for a pharmaceutical experiment station, the first one, and, thus far, the only one of its kind in this country. This entire sum, though small as compared with the agricultural grants, is devoted to research. The department of pharmacy also enjoys the income of the Hollister Fellowship Fund of $5,000